
4. A New Generation of Information Products and Services

The Challenge. NLM's current products and services serve the health professions very well, but more are needed. Recent improvements have included:

- 24-hour access to online databases
- GRATEFUL MED front-end search system for health professionals' personal use
- Improved interconnections between numerous databases
- Elimination of monthly minimum charges, introduction of reduced charges for students, and increased flexibility in arrangements for MEDLINE use by educational and research institutions
- Establishment of DOCLINE nationwide to facilitate interlibrary borrowing of medical literature
- AIDSLINE and other special information services in response to national initiatives against this epidemic.

These are excellent examples of NLM's responsiveness to changing needs. In addition, NLM should put in place a system to monitor continuously the actual use of its products and services at the level of individual health practitioner, student and researcher. Furthermore, it should establish a continuous "production line" of improved information products and services that are immediately responsive to the needs so identified. This research and development production line should be in addition to the more long range, basic research in which NLM is already engaged.

User Studies

At its most fundamental level, an Outreach Plan must specify the means to create awareness among the Nation's health professionals that there are excellent—and extremely valuable—information products and services available from NLM. These services, however, will remain unknown to many unless an effective marketing field force can be created. NLM has a variety of activities to publicize its services, including exhibits, brochures, videos, and television public service announcements. Publicity efforts must be greatly increased in number and scope if the health professional community is to realize the extensive benefits of using the latest biomedical information available directly from NLM and its network of medical libraries. As a first step to increasing awareness, NLM must identify impediments to the use of computerized biomedical databases—be they technical, behavioral, or financial—especially among health professionals engaged in patient care.

A well-conceived program of user studies would build upon the excellent efforts already under way, such as the Library's innovative use of the Critical Incident Technique to study the impact of MEDLINE-derived information on the professional practice of medicine. A recent survey of the information practices and needs of health-care providers in rural North Dakota¹⁴ establishes important baseline measures for assessing the impact of prototype outreach intervention in rural communities. The establishment of permanent feedback mechanisms to assess user satisfaction with current systems and to advise on the need for enhancing current systems and developing new ones should be encouraged. An exemplar of the Library's current efforts to create such user linkages is the "efficacy tester" panel of health professionals that guides the continuing development of GRATEFUL MED, NLM's highly successful software program for searching

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MEDLINE. Evaluation studies and user panels of this kind not only point the way to the development of optimally designed products that are truly responsive to the needs of users, but they can also contribute significantly to our intellectual understanding of the scientific communications process that, ultimately, succeeds or fails in transferring the results of biomedical research from the bench to the bedside.

New Products and Services

In 1965, recognizing the enormous potential of research in improving information services for health professionals, the President's Commission on Heart Disease, Cancer, and Stroke found that

Of paramount importance is the conduct of an intramural research and development program to explore and exploit new technologies for more efficient management of the world's biomedical literature.¹⁵

NLM has had an internal research and development capability for more than twenty years. The Lister Hill National Center for Biomedical Communications has conducted invaluable R&D in biomedical communications since its inception in 1968. Modern technologies and the need to reach out to health professionals present new challenges and opportunities for NLM's R&D programs.

First and foremost, it is critical that the information services that NLM provides be useful to all health professionals engaged in research, education, and, especially, direct patient care. Some of NLM's present services may need to be changed, and new services may be needed to meet the specific needs of health-care practitioners. In order to design future products that utilize the latest information and computer technologies it will be necessary to expand existing intramural research and development programs: a continuous production line is needed.

Based in part on findings from the user studies described in the preceding section, it can be expected that some of these new products may well take on forms and functions markedly different from those presently available to NLM's user community. These may place progressively greater reliance on access to full-text information, factual databases, and electronic image libraries—portions of which may be integrated with such artificial intelligence programs as computer-assisted clinical consultation systems. For example, NLM is developing an image display capability for the online version of McKusick's *Mendelian Inheritance in Man* (MIM) text, so that clinical and radiographic pictures can be combined with text on the user's computer terminal display. A videodisk image library is also an important diagnostic feature of the AI/RHEUM expert system intended for use by the non-rheumatologist clinician.

NLM's current products and services can also serve as the foundation for the development of a new and expansive access initiative. GRATEFUL MED, the microcomputer-based software package that provides an easy-to-use interface to selected databases on NLM's MEDLARS system, should continue to be enhanced. The addition of new and more powerful search capabilities and post-search processing aids that display the most important articles first, or provide cues enabling the user to identify those articles likely to be most relevant, would be beneficial. DOCLINE, NLM's automated interlibrary loan request and referral system, should be linked to GRATEFUL MED so that individual health professionals, not just libraries, may enter a request for a copy of an article into the document delivery system at the time of the GRATEFUL MED search.

New databases likely will be needed. In response to the AIDS crisis, NLM initiated AIDSLINE, which contains more than 13,000

references to scientific articles about AIDS vitally important to the researcher and clinician. AIDSLINE can be accessed through GRATEFUL MED as well as through most computer terminals equipped with modems. It is critical that NLM continue to be responsive to national health concerns in this manner.

Another area of growing national concern is occupational and environmental health. NLM has an active program in toxicology information, evidenced by the TOXNET® system that includes such databases as TOXLINE®, the Toxicology Data Bank (TDB), and the Hazardous Substance Data Bank (HSDB®). In addition to bibliographic citations, the TOXNET files contain scientifically reviewed and edited state of the art textual summaries, along with factual data on acute and chronic toxic effects of more than 90,000 chemicals. There is a need for increased understanding and training on the part of the health professional about occupational or environmental exposure as a causative factor in disease. Linked to this is the need to create even better, more medically focused, information resources. Efficient, reliable access to these full-text and numeric databases is needed, especially during emergency situations involving hazardous materials.

Finally, the Panel favors adapting the IAIMS concept to the health-care practitioner not located in a major academic health/science center. The IAIMS program is intended to develop a limited number of prototype integrated information systems that can be used by major academic medical centers. It was never targeted to smaller community hospitals, and the individual practitioners they serve. As an independent but parallel activity, NLM should identify a non-university medical site for an experimental implementation of an advanced information access system. This might provide a single point of

access for the many forms of information required by the practitioner—laboratory data, hospital admitting data, patient records, and information in data banks and the literature. Thus, new ways to implement the concept of electronic online services to the community-based physician would be explored. The success of such an experiment may ultimately rest on the products of the Unified Medical Language System (UMLS) project, a long-term collaborative research effort by NLM scientists and their colleagues in the medical informatics community. Their goal is to build an increasingly intelligent automated system that understands biomedical terms and their interrelationships across a variety of machine-readable sources including those found in the biomedical research literature, clinical medicine, and health care administration.

Recommended Action. *NLM should accelerate intramural R&D on products and services that are optimally responsive to the information needs of health professionals by:*

- *Placing a high priority on research to ascertain the information requirements of U.S. health professionals, the suitability of current means for acquiring health-related information, and impediments to such acquisition. Using these data, NLM should mount a national campaign to increase awareness of its information products and services among all health professionals in all settings, and put in place permanent feedback mechanisms to ensure their optimal utility. It is estimated that incremental funding of \$2 million is required for this purpose in FY 1990.*
- *Expanding and enhancing existing intramural research and development programs leading to the improvement of current information products and services and the creation of new systems. It is estimated that an increment of \$3 million is required in FY 1990 to pursue these objectives successfully.*

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Following are the detailed actions that will accomplish this recommendation:

- A. Initiate a nationwide baseline survey to establish an overall measure of the extent to which health professionals in specified categories know about, have access to, and use computerized biomedical and health-related databases. The survey should also address such fundamental questions as the reasons for non-use and whether those who use MEDLINE do so directly from NLM or through other means.
- B. Target segments of the health professional community, initially medical students, physicians practicing in rural settings, underserved minorities, and others unfiliated with major academic centers, for in-depth study using the focus group technique and/or related means for engaging in close interaction with and direct observation of prospective users of NLM's information products and services. These studies should seek to determine the role that NLM's information products currently play as these health professionals carry out their daily activities. Findings from these activities also can serve as a valuable aid in the design of new and innovative products to meet those information needs not yet served.
- C. Consider the development of an extensive publicity campaign, targeting specific NLM products and categories of prospective user groups. The campaign should consider a number of options such as print media, including notices in medical and health-related journals and direct mailings to physicians' offices; electronic media, including public service announcements, news releases and personal appearances by NLM senior staff on professionally-oriented programming produced for the medical public; and technical demonstrations and exhibits at specialty society meetings. These outreach efforts should be accompanied by imaginative promotional offerings and incentives encouraging trial use and adoption of NLM's diverse array of information management systems. Appropriate criteria for assessing the success of these efforts should be explicitly defined and applied.
- D. Establish coalitions and collaborations with governmental, academic, and professional organizations with the objective of encouraging access to, competency in, and the use of computerized database systems as a requirement for credentialing or quality assurance or both. Such relationships could also provide NLM with additional avenues for obtaining advice and feedback to assure the Library that its services are maximally relevant.
- E. Accelerate the development of GRATEFUL MED as a convenient and powerful access vehicle for individual users of MEDLARS.
- F. Accelerate experimentation with new and novel information products incorporating full-text information, electronic images, and intelligent forms of knowledge representation applicable to the special needs of practicing health professionals, especially those persons located in isolated or rural settings.
- G. Expand the scope of DOCLINE by developing the linkages necessary to support implementation of an integrated GRATEFUL MED and document delivery package available to all U.S. health professionals. This integrated package should provide documents directly to health professionals in a timely and cost-effective way. NLM should increase the use of facsimile or other electronic transmission of full-text documents to improve the timeliness of the document delivery system.

- H. Develop new database systems containing the latest information required by health professionals in areas of national concern. The rapid development of AIDSLINE and related NLM AIDS information services is an excellent example of NLM's quick response to the Nation's special information services needs.
- I. Extend IAIMS concepts to practitioners outside the academic health sciences center. Experiment with the development of a prototype information network within a small- to mid-sized community health care institution.
- J. Improve coverage of and focus on occupational and environmental medicine in NLM's toxicology data banks, particularly the Hazardous Substance Data Bank (HSDB); facilitate use of these data banks by physicians, through better access software such as GRATEFUL MED, or through expert systems; join the efforts of other Federal agencies such as the Agency for Toxic Substances and Disease Registry (ATSDR) and the National Institute for Environmental Health Sciences (NIEHS) in increasing awareness and knowledge by physicians about occupational and environmental health issues, and about the available information resources pertaining to these issues.

Recommended Resources. To summarize resource requirements for intramural R&D at NLM:

Incremental Dollars in Millions					
	FY 90	FY 91	FY 92	FY 93	FY 94
User Studies					
National survey	\$0.5	\$0.6	\$0.8	\$1.0	\$1.1
In-depth studies	0.5	0.6	0.8	1.0	1.1
Publicity campaign and exhibits	0.5	0.6	0.8	1.0	1.1
Coalitions and collaboration	0.5	0.6	0.8	1.0	1.1
Subtotal, User Studies	\$2.0	\$2.4	\$3.2	\$4.0	\$4.4
New Products and Services					
	FY 90	FY 91	FY 92	FY 93	FY 94
Accelerate CM development	\$0.8	\$1.0	\$1.0	\$1.1	\$1.3
Full-text experimentation	0.5	0.5	0.5	0.5	0.5
Expand DOCLINE	0.5	0.8	0.9	1.0	1.2
New databases	0.3	0.3	0.4	0.4	0.5
Prototype network in community setting	0.5	0.6	0.6	0.6	0.7
Environmental medicine	0.4	0.4	0.4	0.4	0.4
Subtotal, New Products and Services	\$3.0	\$3.6	\$3.8	\$4.0	\$4.6
Total	\$5.0	\$6.0	\$7.0	\$8.0	\$9.0
FTEs	10	11	12	13	13